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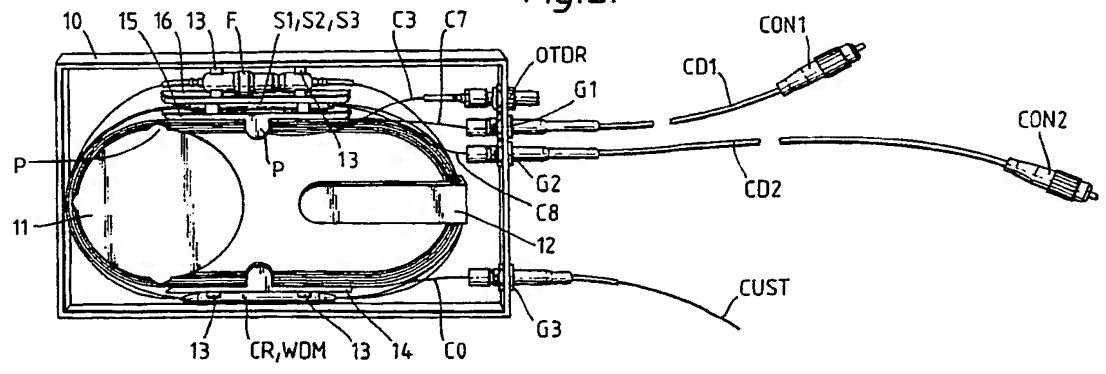
(54) Junction box for optical communications cords and gland assembly for cord.

(57) A junction box for linking a first optical communications cord with two or more second optical communications cords, comprising: a sealable, flat housing having internal formations for organising optical fibres; terminals, preferably glands, along one edge of the housing for connection to the first and/or second optical communications cords; passive optical components including a 1x2 fibre-optic coupler all interconnected by internal optical fibres with the terminals, the internal fibres all being organised together in a single loop parallel to the major faces of the housing; and clamps along the inside of at least one different edge of the housing between the loop and the edge wall of the housing, retaining the passive optical components.

Fig.2.



EP 0 409 390 A2

JUNCTION BOX FOR OPTICAL COMMUNICATIONS CORDS, AND GLAND ASSEMBLY FOR CORD

One invention relates to a junction box for linking a first optical communications cord with two or more second optical communications cords, such as is required in telephone subscribers' premises and in exchanges. A second, related invention concerns gland assemblies for optical cords entering such a junction box.

The purpose of the first invention is to provide such a juction box which is capable of retaining safely inside the box the passive optical components, such as couplers and filters, and organising efficiently the interconnecting optical fibres; hitherto, the passive optical components have had to be attached externally of boxes containing the interconnecting optical fibres

Accordingly, the first invention provides a junction box for linking a first optical communications cord with two or more second optical communications cords, comprising; a sealable, flat housing having internal formations for organising optical fibres, terminals along one edge of the housing for connection to the first and/or the second optical communications cords; passive optical components including a 1x2 fibre-optic coupler all interconnected by internal optical fibres with the terminals, the internal fibres all being organised together in a single loop parallel to the major faces of the housing; and clamps along the inside of at least one different edge of the housing between the loop and the edge wall of the housing, retaining the passive optical components. Usually, at least one of the internal fibres is spliced along its length and the splice is retained in one of the edge clamps.

Preferably, the clamps are along two parallel edges of the housing so that all the passive optical components and any splices are parallel to each other.

Conveniently also, the internal formations comprise an accumulator extending in the plane of the loop from the outside to the centre of the loop. This is useful during the initial organising of the fibres within the box, and of course assists in retaining fibres which have become shorter as a result of splicing during subsequent servicing.

In order to isolate the components from shock, the clamps preferably include resiliently deformable pads between which the passive optical components are retained.

The housing is conveniently manufactured as a two-piece plastics moulding, one part of which is preferably integral with the internal formations and preferably also the clamps.

The optical fibres of the first and/or second optical communications cords preferably extend through the wall of the box, and the terminals are preferably glands which support the cords at the wall. The external cord has a protective sheath, forming a rugged connector, and in this case the sheath is stripped off the portion within the housing.

It is the purpose of the second invention to provide a gland assembly which performs this task. Accordingly, the second invention provides a gland assembly for an optical cord having an optical fibre core, a sheath, and an intermediate layer of non-metallic strength members, the assembly comprising: a tube having external formations for connecting it to a body through which it extends; and a tubular end cap with an apertured base for the passage of the optical fibre core; there being an annular clearance space between the cylindrical inner wall of the end cap and the outer wall of one end of the tube just sufficient to trap therebetween the evenly-spread strength members bent back from the end of the optical cord held within the tube. The gland assembly may conveniently be pre-connected to the cord before assembly in the junction box.

Preferably, the external formations comprise screw-threading adjacent an annular shoulder, the assembly further comprising a nut in screw-threaded engagement with the tube, for clamping between the nut and the shoulder the annular edge of a circular-apertured body.

Advantageously also, the tube and the end cap have co-operating surface formations such that they are a snap fit when trapping the strength members of the optical cord. There is preferably a tightly-fitting sleeve over part of the tube and the optical cord, and preferably the sleeve is heat-shrunk.

The end cap may be adhered to the tube using a suitable adhesive such as an epoxy resin which allows sufficient time during assembly before it hardens.

A junction box embodying the first invention and incorporating glands embodying the second invention will now be described by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is a diagram of the optical components and sleeved fibres contained in the junction box housing;

Figure 2 is a top perspective view of the junction box with its lid removed;

Figure 3 is a longitudinal section on the axis of one of the glands of the junction box; and

Figure 4 is a cross-section, to an enlarged scale, through the reinforced optical cord attached to the gland of Figure 3.

With reference to Figures 1 and 2, an optical fibre cord "CUST" in the form of a sleeved optical fibre from a telephone subscriber's premises is connected by the junction box to two networks for transmissions at different wavelengths, for example 130nm and 155nm, by way of reinforced optical connector cords CD1 and CD2 respectively terminated with connectors CON1 and CON2. In this preferred example, it is also connected to an OTDR (optical time domain reflector) terminal "OTDR" mounted on the junction box.

The subscriber's cord CUST enters the junction box through a gland G3 and continues as a sleeved fibre C0 to a wavelength division multiplexer MDM which connects it to two sleeved fibres C_1, C2. Fibres C1 and C2 are spliced at S1 and S2 to respective sleeved fibres C3 and C4 connected to the OTDR terminal and to a 1x2 coupler CR respectively. The coupler CR connects fibre C4 with sleeved fibres C5 and C6; fibre C5 is spliced at S3 to sleeved fibre C7 which is a continuation of the core of the external cord CD1 supported by gland G1. Fibre C6 is connected to a filter F; this is connected to sleeved fibre C8 which is a continuation of the core of the other external cord CD2, supported by gland G2.

Each internal fibre C0 to C8 is chosen deliberately to have the same length, in this example 1.5 m, to facilitate its organisation within the junction box.

The junction box comprises a flat, seal able rectangular housing 10 which is a plastics injection mouldlng in two parts: the base and side walls as shown, and a plain lid (not shown) secured by clips. Integrally moulded with the major part of the housing 10 are projections P and an accumulator 12 in a plane parallel to the major faces of the housing, and three upstanding clamps 14, 15 and 16 for the splices and the passive optical components, i.e. the multiplexer WDM, the 1x2 coupler CR and the filter F.

The three glands G1, G2 and G3, and the OTDR terminal, are all situated in line along the same side wall of the housing. However, in an alternative example (not shown), the sleeved fibre C0 exits the box through a slot in the lid, and there is no gland G3; the continuation CUST of this optical fibre outside the box has suitable oversleeving for protection, and some clamping means for preventing the internal fibre C0 from being pulled. In this alternative, the box is supplied with excess cord (CUST) coiled on a drum around other formations on the external surface of the lid, and a fusion splice protection package conveniently secured on the lid for subsequent use during installation.

The passive optical components CR, WDM and F and the three splices S1, S2 and S3 are arranged mutually parallel along the inside of opposite edges of the housing 10, between the clamp 14 and one side wall, between the clamps 15 and 16, and between the clamp 16 and the other side wall. Resiliently deformable foam pads 13 assist in retaining these components while protecting them from shock; the components are a push fit, facilitating assembly of the box.

The internal fibres C0 to C8 are all coiled together in a common, oval loop, between the clamps 14 and 15 and the end walls. This is possible because they have a common length. The organisation of the fibres into a loop is important because they do not tolerate bending to a radius of curvature less than 40mm. Each sleeved fibre comprises an optical fibre with a PTFE or other polymer sleeving which has a memory for a straight configuration, so that it springs back to a straight line when released, and it is resiliently biased against the various constraints within the housing when coiled, to assist in its retention in the housing.

The loop passes around a drum 11 and under the projections P and the accumulator 12.

One of the glands G1, G2, G3 is shown in greater detail in Figure 3, and the reinforced external cord CD1, CD2 in cross-section in Figure 4. The cord comprises a sleeved optical fibre 20 surrounded by a layer 21 of non-metallic strength members of Kevlar (Registered Trade Mark) polymeric fibre, and an outer plastics sheath 22. The diameter of the sleeve is 1mm and that of the fibre is 250 microns. The gland comprises a tubular body 27, a nut 25, a heat-shrunk sleeve 23 and an end cap 24, and is secured through an aperture in the wall of the housing 10. An annular shoulder 28 on the body 27 bears against the wall 10 from one side, while the nut 25, in screw-threaded engagement with the body 27, bears against it from the other side. The cord, partially stripped of its sheath 22 and strength member fibres 21, is pushed through the tubular body 27 so that the end of the sheath 22 is flush with the end of the body 27, and it is sealed in place by means of the heat-shrink sleeve 23. An excess length of the fibres 21, commensurate with the length of the end cap 24, is bent back outside the body 27, spread evenly around it, and is trapped thereby by pushing the end cap 24 over the end of the body 27. The sleeved optical fibre 20 extends through an aperture in the base of the end cap 24.

In the example shown, an epoxy resin is used to secure the end cap to the cylindrical outer surface of the body 27 and to seal the termination. Alternatively, or in addition, co-operating projections (not shown) on the end cap 24 and body 27 ensure a snap fit, facilitating assembly.

Claims

1. A junction box for linking a first optical communications cord with two or more second optical communications cords, comprising: a sealable, flat housing (10) having internal formations for organising optical fibres and characterised in that the junction box further comprises terminals (G1, G2 and G3) along one edge of the housing (10) for connection to the first and/or the second optical communications cords (CD1), (CD2), passive optical components including a 1x2 fibre-optic coupler (WDM) all interconnected by internal optical fibres (C0 ....C8) with the terminals, the internal fibres (C0 .... C8) all being organised together in a single loop parallel to the major faces of the housing; and clamps (14, 15, 16) along the inside of at least one different edge of the housing (16) between the loop and the edge wall of the housing, retaining the passive optical components (WD, CR, F).

2. A junction box according to Claim 1 and further characterised in that at least one of the internal fibres (C0 .... C8) is spliced along its length and the splice is retained in one of the edge clamps (14,15, 16), the clamps (14, 15, 16) further including resiliently deformable pads (13) between which the passive optical components (WDM, CR, F) are retained.

3. A junction box according to Claim 2 and further characterised in that the clamps (14, 15, 16) are along two parallel edges of the housing (10) so that all the passive optical components (WDM, CR,F) and any splices are parallel to each other.

4. A junction box according to Claim 3 and further characterised in that the internal formations comprise an accumulator (12) extending in the plane of the loop from the outside to the centre of the loop.

5. A junction box according to any one of Claims 1 to 5 and further characterised in that the housing (10) is a plastics moulding and the internal formations are moulded integrally with the housing, the clamps (14, 15, 16) being moulded integrally with the housing (10).

6. A gland assembly for an optical cord having an optical fibre core (20), a sheath (22), and an intermediate layer of non-metallic strength members (21), the assembly being characterised in that it comprises a tube (27) having external formations (28) for connecting it to a body through which it extends; and a tubular end cap (24) with an apertured base for the passage of the optical fibre core; there being an annular clearance space between the cylindrical inner wall of the end cap and outer wall of one end of the tube (27) just sufficient to trap therebetween the evenly-spread strength members bent back from the end of the optical cord held within the tube.

7. A gland assembly according to Claim 6 and further characterised in that the external formations comprise screw-threading adjacent an annular shoulder (28), the assembly further comprising a nut (25) in screw-threaded engagement with the tube (27), for clamping between the nut (25) and the shoulder (28) the annular edge of a circular-apertured body the tube (27) and the end cap (24) having co-operating surface formations such that they are a snap fit when trapping the strength member of the optical cord.

8. A gland assembly according to Claim 7 and further characterised in that it is connected to an optical cord having an optical fibre core (20), a sheath (22), and an intermediate layer of non-metallic strength members (21), with the sheath (22) engaging the inner surface of the tube (27), an excess length of the strength members (21) being spread evenly and trapped between the end cap (25) and the cylindrical outer surface of the tube (27).

9. A gland assembly and optical cord according to Claim 8, and further charcterised in that it comprises a tightly-fitting sleeve (23) over part of the tube (27)and the optical cord.

10. A gland assembly and optical cord according to Claim 9, and further characterised in that the sleeve (23) is heat-shrunk, and in that the end cap (24) is adhered to the tube (27).

Fig.1.

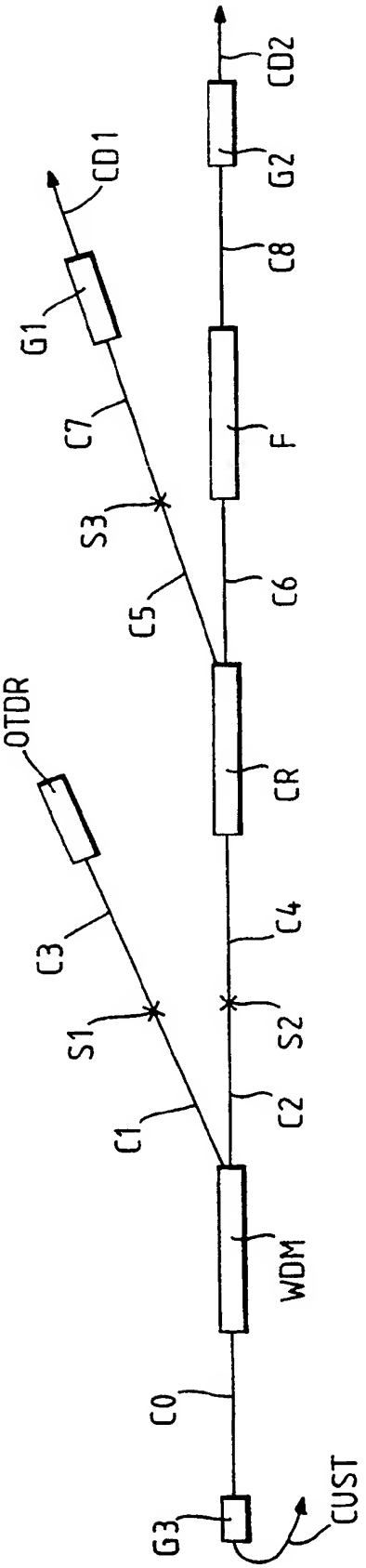

OTDR
C3
S1
C1
C2
S2
C4
CR
C5
S3
C7
G1
CD1
C6
F
C8
G2
CD2
WDM
C0
G3
CUST

Fig.2.

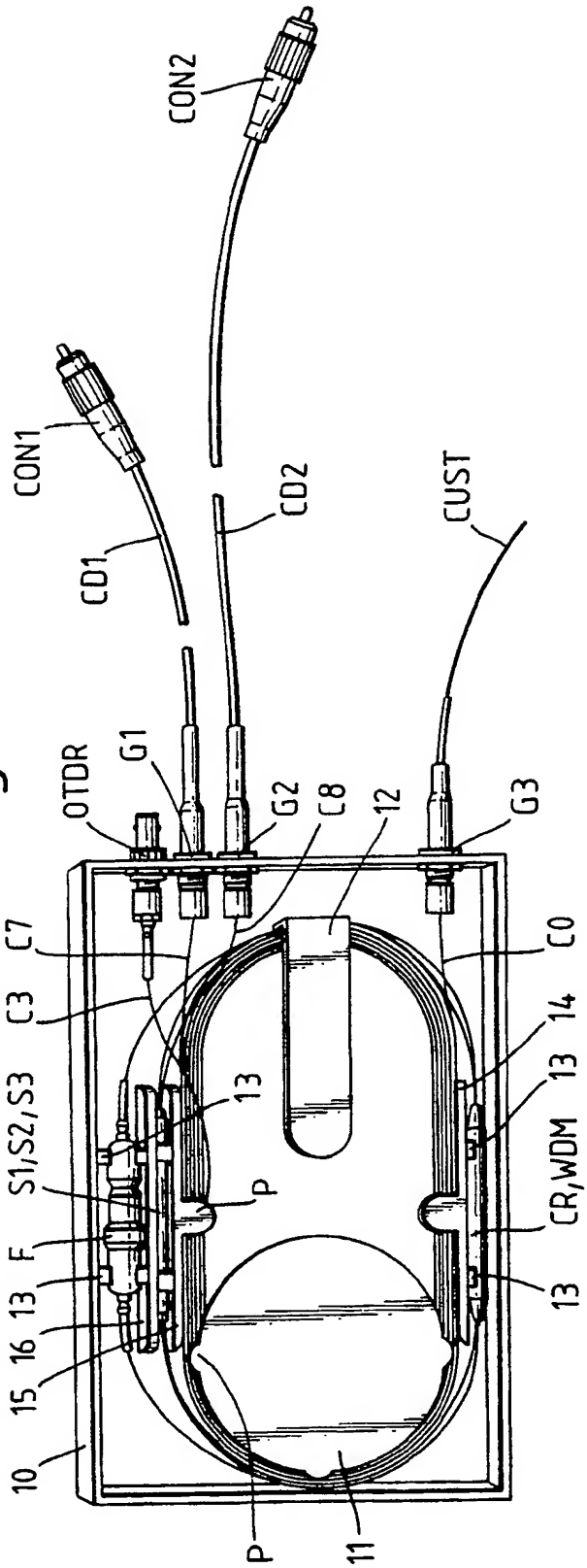

CON2
CON1
CD1
CD2
CUST
OTDR
G1
G2
C8
12
G3
C7
C3
S1,S2,S3
13
P
F
13
16
15
10
C0
14
13
CR,WDM
13
P
11

Fig.3.

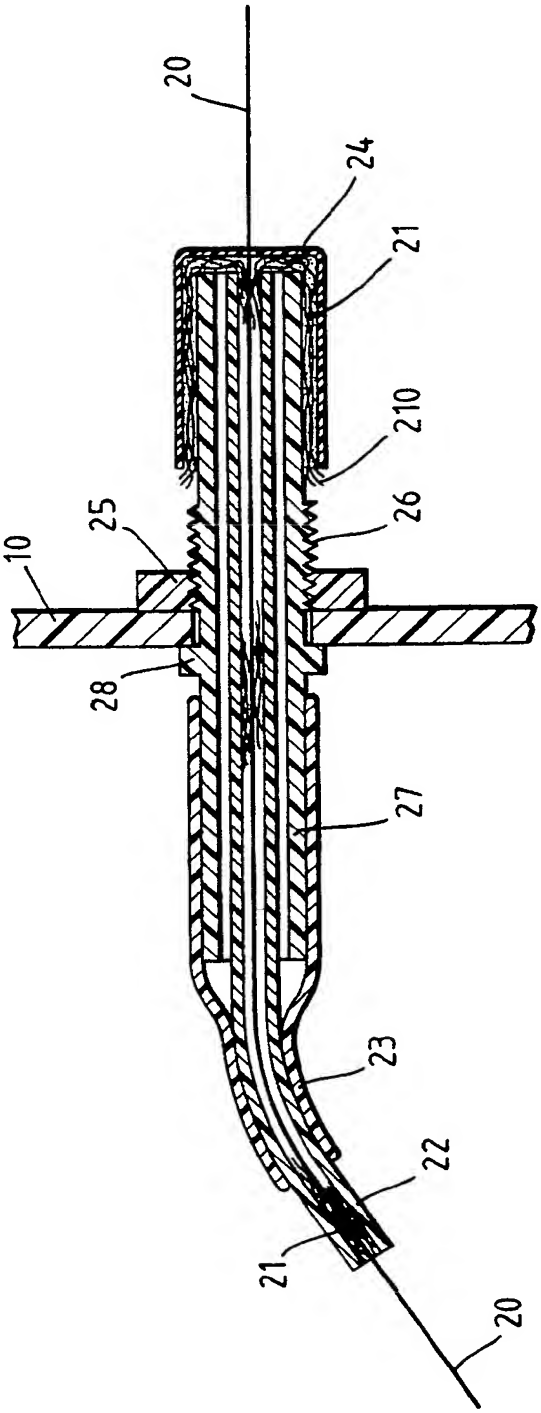


Fig.4.

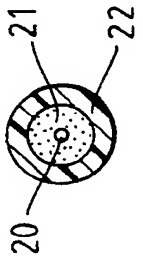


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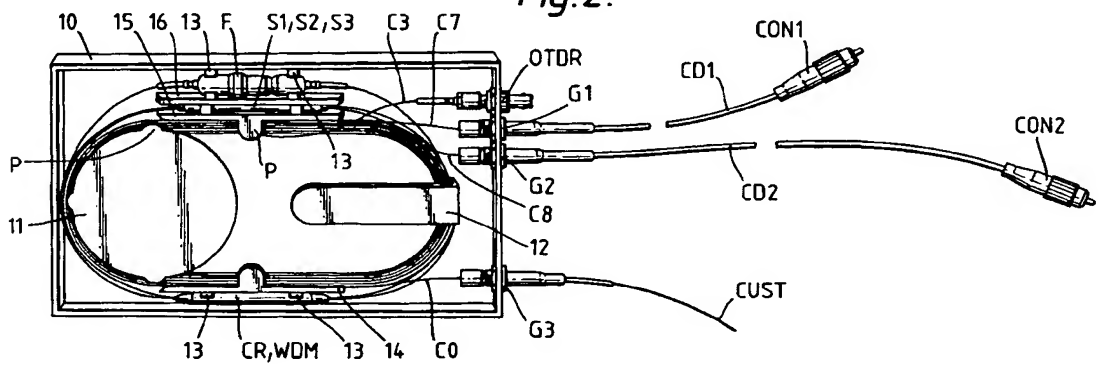
Fig. 2.



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EUROPEAN SEARCH REPORT

Application Number

EP 90 30 5815

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	EP-A-0 182 494 (TELEPHONE CABLES LTD) * Page 3, line 7 - page 4, line 29; claim 1; figure 1 *	1	G 02 B 6/44
Y	US-A-4 650 278 (MACIEJKO et al.) * Column 1, lines 44-65; figures 1,6,7 *	1	
A	DE-A-3 413 401 (PHILIPS PATENTVERWALTUNG GmbH) * Page 4, lines 6-28; figure 1 *	2-5	
A	US-A-4 171 867 (COCITO) * Page 2, lines 43-61; figure 2 *	1	
X	US-A-4 826 277 (WEBER et al.) * Column 3, line 43 - column 4, line 25; column 6, lines 9-22; figures 1-9 *	6	
Y		7-10	
Y	EP-A-0 017 319 (THE PLESSEY CO., LTD) * Page 5, lines 1-9; page 6, lines 17-19; figures 1,2 *	7-10	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A	EP-A-0 131 283 (AUGAT INC.) * Page 9, lines 26-34; figure 5 *	6	G 02 B H 02 G
E	US-A-4 948 222 (CORKE et al.) * Column 3, line 43 - column 6, line 56; figure 3 *	6-10	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	14-10-1991	GRUNFELD M.Y.E.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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European Patent Office

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ All claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for all claims.

☐ Only part of the claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid,

namely claims:

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions.
namely:

1. Claims 1-5: Optical communications cord junction box
2. Claims 6-10: Gland assembly for an optical cable

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid,

namely claims:

☐ None of the further search fees has been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims,

namely claims: